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**In vivo imaging of embryonic stem cells reveals patterns of survival and immune rejection following transplantation.**

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**Public Summary:**

**Scientific Abstract:**

Embryonic stem cell (ESC)-based transplantation is considered a promising novel therapy for a variety of diseases. This is bolstered by the suggested immune-privileged properties of ESCs. In this study, we used in vivo bioluminescent imaging (BLI) to non-invasively track the fate of transplanted murine ESCs (mESCs), which are stably transduced with a double fusion reporter gene consisting of firefly luciferase (FLuc) and enhanced green fluorescent protein (eGFP). Following syngeneic intramuscular transplantation of  $1 \times 10^6$  mESCs, the cells survived and differentiated into teratomas. In contrast, allogeneic mESC transplants were infiltrated by a variety of inflammatory cells, leading to rejection within 28 days. Acceleration of rejection was observed when mESCs were allotransplanted following prior sensitization of the host. Finally, we demonstrate that the mESC derivatives were more rapidly rejected compared to undifferentiated mESCs. These data show that mESCs do not retain immune-privileged properties in vivo and are subject to immunological rejection as assessed by novel molecular imaging approaches.

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